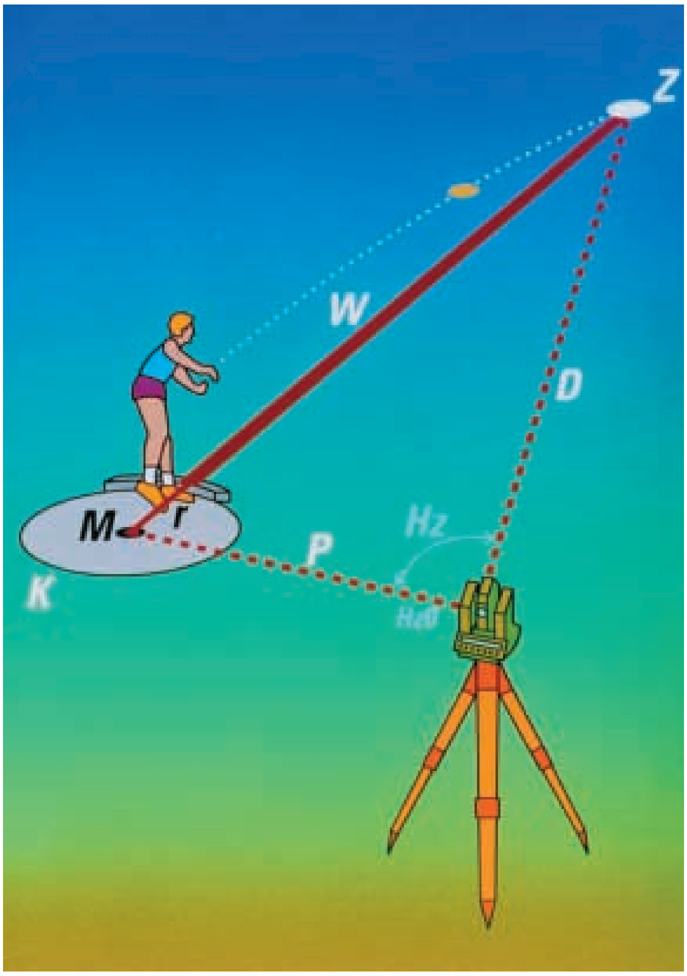
Thanks to high-precision chronometry, 75 metre throws can be measured at the speed of light to an accuracy of one millimetre!

Time is the single most accurately defined and reproducible variable in modern physics. The distance measuring technology which is being used in Australia is also based on high-precision chronometry combined with laser technology. With laser distance measurement, quartz crystal oscillations are used to determine the time it takes for a laser light pulse to travel from the start line or throw line to the spot where the athlete or the object thrown lands. Such an invisible “infra-red light flash“ covers almost 300,000 km in just one second. The outbound and return paths of a 75 m throwing distance are covered in just half a millionth of a second (0.0000005 sec.). But the speed at which the light pulse travels is also affected by temperature, humidity and brightness. Hence the Leica laser tacheometer, which automatically performs hundreds of such measurements simultaneously within 1-2 seconds, takes these parameters into account. It uses these measurements to compute the exact distance to an accuracy of 2 mm. Yet the measuring software stored in the Leica TCA views the results only" as a rough input: at the same time an oblique distance laser measuring capability also determines the angles opto-electronically. These values are combined with the results of distance measurement by geometry. The combination of these two methods means that a 75 m throwing distance can today be resolved to an accuracy of 1 mm with a single key press. But because the impact point of the object thrown can only seldom be defined so accurately, distance measurements are generally rounded to the nearest centimetre at athletics competitions.

__The laser triangulation principle used to measure distances in Sydney.__



__In the disciplines which involve throwing from a throwing-circle, such as discus, hammer or shot, the automated Leica TCA tacheometer is set up before the start of the competition in a location near the throwing-circle (K). The centre of the throwing-circle (point M) is then determined and angle Hz 0 and laser distance measurement are used to measure its relative position (P) from the instrument midpoint. The competition can now begin. The discus flies through the air and lands in the marked sector. At the point where the discus strikes the ground, the judge lightly places the target mark (point Z) in the ground. The competition surveyor roughly aligns the telescope and presses the start button. The automatic system now seeks the midpoint of the target mark, activates millimetre-precise laser beam measurement of the distance (D) between instrument and target mark (Z), and determines the horizontal angle (Hz) between the centre of the throwing-circle (M, Hz 0) and the target (Z). The software calculates the first throwing distance (W) by trigonometry, deducts the radius of the throwing-circle and rounds the result to the nearest centimetre. A few seconds after the start button has been pressed, the validated distance appears on the judges' screens automatically. All they have to do is press a button to confirm the result and the distance is automatically transmitted to the ranking lists, stadium display boards and television screens.__